

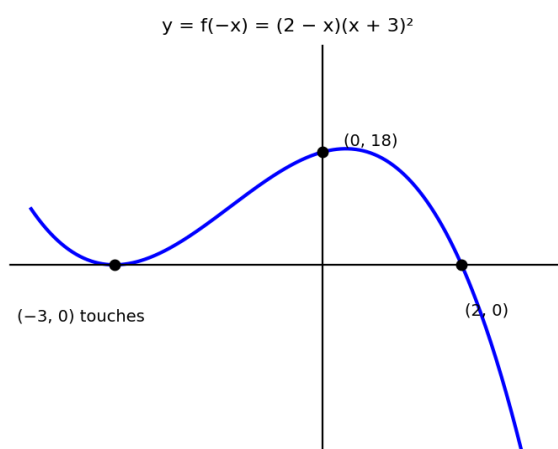
OxfordAQA International AS Mathematics — Unit P1 (9660/MA01)

Pure Mathematics · 6 May 2026 · Worked solutions and indicative mark scheme

Mark codes: **M** = method, **A** = accuracy (depends on the M mark), **B** = independent mark, **E** = explanation/reasoning, **ft** = follow-through allowed. This is an **unofficial** worked solution with an **indicative** mark scheme written to match the marks available on the paper. It is not the official OxfordAQA mark scheme, so the exact mark allocation an examiner uses may differ.

Question 1 — Sequences		5 marks
(a)(i) [1 mark]		
$u_4 = u_5 + 9 = 139$, $u_3 = 148$, $u_2 = 157$, $u_1 = 166$ (each term is 9 more than the next). Answer: 166		B1
(a)(ii) [1 mark]		
$u_n = 166 - 9(n - 1) = 76 \Rightarrow 9(n - 1) = 90 \Rightarrow n - 1 = 10$. Answer: n = 11		B1
(b) [2 marks]		
$u_n = 166 - 9(n - 1) = 175 - 9n$		M1
p = 175, q = 9		A1
(c) [1 mark]		
Arithmetic sequence (constant common difference of -9).		B1
Question 2 — Indices and surds		6 marks
(a) [2 marks]		
$(3x^{5/2} + x^{1/2})(5x^{3/2} - 4x^{-1/2}) = 15x^4 - 12x^2 + 5x^2 - 4$		M1 (at least 3 correct terms)
= $15x^4 - 7x^2 - 4$		A1
(b) [4 marks]		
Multiply top and bottom by $(\sqrt{10} - \sqrt{3})$:		M1
Denominator: $(\sqrt{10} + \sqrt{3})(\sqrt{10} - \sqrt{3}) = 10 - 3 = 7$		B1
Numerator: $(9\sqrt{10} + 2\sqrt{3})(\sqrt{10} - \sqrt{3}) = 90 - 9\sqrt{30} + 2\sqrt{30} - 6 = 84 - 7\sqrt{30}$		M1
Divide by 7: $(84 - 7\sqrt{30})/7 = 12 - \sqrt{30}$, so $m = 12$ and $n = 30$ (shown).		A1
Question 3 — Factor theorem and graph transformation		8 marks
(a) [2 marks]		
$f(3) = 27 - 36 - 9 + 18$		M1
= 0 , so $(x - 3)$ is a factor by the Factor Theorem.		A1 (conclusion stated)

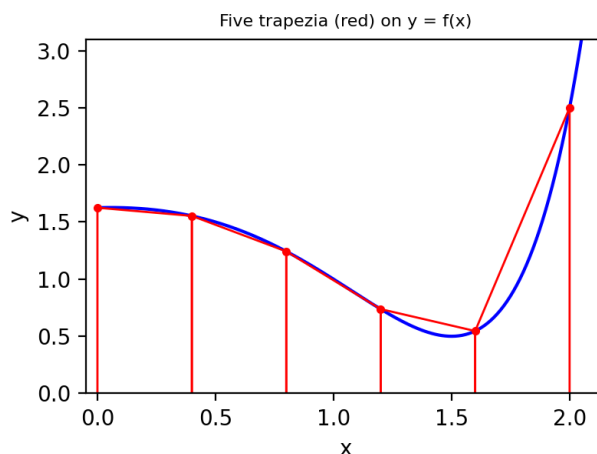
(b) [3 marks]	
$f(x) = (x - 3)(x^2 + px - 6)$: matching x^2 coefficient -4 gives $p - 3 = -4$, so $p = -1$ (or by division)	M1
$x^2 - x - 6 = (x - 3)(x + 2)$	M1
$f(x) = (x + 2)(x - 3)^2$, so $a = 2$, $b = -3$	A1
(c) [3 marks]	
$y = f(-x)$ is a reflection of $y = f(x)$ in the y -axis. $f(x)$ has a root at $x = -2$ and a repeated root at $x = 3$, so $f(-x)$ has a root at $x = 2$ and a repeated (touching) root at $x = -3$.	B1 (roots / touch correctly placed)
y -intercept: $f(0) = 18$, so the curve passes through $(0, 18)$.	B1
Shape: $f(-x) = (2 - x)(x + 3)^2$, a cubic with negative x^3 coefficient (top-left to bottom-right), touching at $(-3, 0)$, crossing at $(2, 0)$.	B1 (shape)



Question 4 — Arithmetic series		10 marks
(a) [2 marks]		
Equal differences: $2(t^2 - 4t - 12) = (t + 6) + (4t^2 - 25t - 70)$		M1
$2t^2 - 8t - 24 = 4t^2 - 24t - 64 \Rightarrow 2t^2 - 16t - 40 = 0 \Rightarrow \mathbf{t^2 - 8t - 20 = 0}$ (shown)		A1
(b)(i) [5 marks]		
$(t - 10)(t + 2) = 0 \Rightarrow t = 10$ or $t = -2$		M1
$t = -2$ gives third term $4(4) + 50 - 70 = -4 < 0$, rejected. So $t = 10$.		E1
Terms: 16, 48, 80, so $a = 16$, $d = 32$		A1
k -th term $= 16 + 32(k - 1) = 32k - 16$; 8th term $= 240$		M1
$32k - 16 = 3 \times 240 = 720 \Rightarrow \mathbf{k = 23}$		A1
(b)(ii) [3 marks]		
$S_n = (n/2)[2(16) + 32(n - 1)]$		M1
$= (n/2)(32n) = 16n^2$		A1
$= (4n)^2$, which is a square number for every positive integer n (shown).		E1

Question 5 — Optimisation		10 marks
(a) [3 marks]		
Twelve rods: 4 lengths of x , 4 widths of w , 4 heights of $(x - 1)$: $4x + 4w + 4(x - 1) = 24$		M1
$8x + 4w - 4 = 24 \Rightarrow w = 7 - 2x$		A1
$V = x(7 - 2x)(x - 1) = x(-2x^2 + 9x - 7) = -2x^3 + 9x^2 - 7x$ (shown)		A1
(b)(i) [5 marks]		
$dV/dx = -6x^2 + 18x - 7$		M1
Set = 0: $6x^2 - 18x + 7 = 0$		M1
$x = (9 \pm \sqrt{39})/6 = 2.5408... \text{ or } 0.4592...$		A1
Valid x needs $x - 1 > 0$ and $w = 7 - 2x > 0$, so $1 < x < 3.5$; reject $x = 0.459$ (negative height).		E1
$V(2.5408...) = 7.510... \text{ so } V_{\max} = 7.51 \text{ m}^3$		A1
(b)(ii) [2 marks]		
$d^2V/dx^2 = -12x + 18$		M1
At $x = 2.54$: $-12(2.54) + 18 = -12.48 < 0$, so the stationary point is a maximum.		A1
Question 6 — Coordinate geometry		9 marks
(a) [5 marks]		
Diagonals of a square bisect at right angles. Midpoint of AC = $((13+3)/2, (5-9)/2) = (8, -2)$		M1 A1
Gradient AC = $(5 - (-9))/(13 - 3) = 14/10 = 7/5$		M1
Perpendicular gradient = $-5/7$		A1
$y + 2 = -(5/7)(x - 8) \Rightarrow 7y + 14 = -5x + 40 \Rightarrow 5x + 7y - 26 = 0$		A1
(b) [4 marks]		
$AC^2 = (13 - 3)^2 + (5 + 9)^2 = 100 + 196 = 296$		M1 A1
Square with diagonal d has area $d^2/2$ ($\text{side}^2 = d^2/2$)		M1
Area = 148		A1
Question 7 — Trapezium rule		7 marks
(a)(i) [2 marks]		
$f(0.8) = (1.6 - 3)^2 \times 2^{-1.4} + 0.5 = 1.2427$		B1
$f(1.6) = (3.2 - 3)^2 \times 2^{0.2} + 0.5 = 0.5459$		B1
(a)(ii) [3 marks]		
$h = 0.4$: Integral $\approx (h/2)[y_0 + y_5 + 2(y_1 + y_2 + y_3 + y_4)]$		M1
$= 0.2[1.625 + 2.5 + 2(1.5534 + 1.2427 + 0.7375 + 0.5459)]$		M1
$= 0.2 \times 12.284 = 2.4568... \approx 2.457$		A1

(b) [2 marks]	
Five trapezia drawn: vertical lines at $x = 0, 0.4, 0.8, 1.2, 1.6, 2$ joined by straight chords to the curve (see sketch).	B1
The curve is convex (concave up) over most of the interval, so the chords (tops of the trapezia) lie above the curve; the extra area outweighs the small gap under the curve at the start, so the estimate is an overestimate. (Check: the true value is about 2.318, below 2.457.)	E1



Question 8 — Differentiation and inequalities 9 marks

(a) [5 marks]	
Check Q lies on G: $81/81 + 4(3) - 5 = 8 \checkmark$ (the question gives this)	—
$y = 81x^{-2} + 4x^{1/2} - 5$	M1
$dy/dx = -162x^{-3} + 2x^{-1/2}$	A1 A1
At $x = 9$: $-162/729 + 2/3 = -2/9 + 6/9 = 4/9$	A1
$y - 8 = (4/9)(x - 9) \Rightarrow y = (4/9)x + 4$ (shown)	A1

(b) [4 marks]	
H on or above L: $(1/3)x^2 - (23/9)x - 50 \geq (4/9)x + 4$	M1
$(1/3)x^2 - 3x - 54 \geq 0 \Rightarrow x^2 - 9x - 162 \geq 0$	A1
$(x - 18)(x + 9) \geq 0$, critical values $x = 18$ and $x = -9$	M1
$x \leq -9$ or $x \geq 18$	A1

Question 9 — Integration and area 9 marks

(a) [2 marks]	
$\int_k^9 24x^{-1/2} dx = [48x^{1/2}]_k^9 = 144 - 48\sqrt{k}$	M1
$144 - 48\sqrt{k} = 48 \Rightarrow \sqrt{k} = 2 \Rightarrow k = 4$ (shown)	A1
(b) [2 marks]	
$\int (9x^{1/2} + x - x^{3/2} - 1) dx$	—
$6x^{3/2} + x^2/2 - (2/5)x^{5/2} - x + c$	B1 B1

(c) [3 marks]	
Between $x = 4$ and $x = 9$, D lies above C, so $\text{Area(R)} = \int_4^9 D \, dx - \int_4^9 C \, dx$	M1
$\int_4^9 D \, dx = [6x^{3/2} + x^2/2 - (2/5)x^{5/2} - x]_4^9 = 96.3 - 39.2 = 57.1$	M1
From (a), $\int_4^9 C \, dx = 48$. Area(R) = 57.1 - 48 = 9.1	A1

(d) [2 marks]	
Translation by (0, 3) moves D up by 3 to give E, so the extra area between $x = 4$ and 9 is a rectangle $5 \times 3 = 15$	M1
Area = 9.1 + 15 = 24.1	A1

Question 10 — Geometric series	7 marks
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(a) [4 marks]	
$a + ar = 200 \Rightarrow a(1 + r) = 200$	B1
$a(1 + r + r^2 + r^3) = 272 \Rightarrow a(1 + r)(1 + r^2) = 272$	M1
Divide: $200(1 + r^2) = 272 \Rightarrow 1 + r^2 = 1.36$	M1
$r^2 = 9/25 \Rightarrow r = \pm 3/5$ (shown)	A1

(b) [3 marks]	
$r = 3/5$: $a(1.6) = 200 \Rightarrow a = 125$	M1 A1
$S_\infty = a/(1 - r) = 125/0.4 = 312.5$	A1

Total: 80 marks